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A study of *Tajuria discalis* Fruhstorfer, 1897 (Lepidoptera, Lycaenidae) from Indonesia (1)

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Abstract *Tajuria discalis discalis* Fruhstorfer, 1897 is redescribed and *T. d. centralis* ssp. nov. from central Bali and *T. d. triangularis* ssp. nov. from east Jawa are described with short biological notes. Some apomorphic characters for *T. discalis* and its sister species, and their biogeographical relationships are discussed.

Key words Lycaenidae, *Tajuria*, *discalis*, Bali, Lombok.

Introduction

Tajuria discalis Fruhstorfer, 1897 had been known as an endemic species to Lombok Island for a long time until one of the authors, Morinaka, found it from central Bali in 1984 (Morinaka, 1988, 1989). After that this species has also been found from Sumbawa Island (Takanami, 1989), west Bali, east Bali, east Jawa, and even Timor Island (Morinaka, 1989). Murayama (1983) described *Tajuria floresica* from Flores Island based on two females, but later Takanami (1986) changed its status to a subspecies of *T. discalis*.

In this paper the nominotypical subspecies from Lombok Island is redescribed and two new subspecies from central Bali and east Jawa are described, respectively. These new subspecies were not fully compared with *floresica* because of lack of material from Flores Island before the authors, but in *floresica* the postdiscal line in the underside of both wings is red according to the original description and this feature is never seen in the nominotypical and the two new subspecies described below. The taxonomic status of the specimens from west and east Bali, Sumbawa, Flores and Timor Island will be clarified in the subsequent paper.

Abbreviations of the type depositories are as follows:

KMNH: Kitakyushu Museum of Natural History, Kitakyushu.

MZB: Museum Zoologi Bogor, Bogor.

NSMT: National Science Museum, Tokyo.

OPU: Entomological Laboratory. Osaka Prefecture University, Sakai.

SCSKU: Graduate School of Social and Cultural Studies, Kyushu University, Fukuoka.

SM: Saitama Zoogeographical Museum, Kawaguchi.

SO: Collection of S. Osada, Urawa.

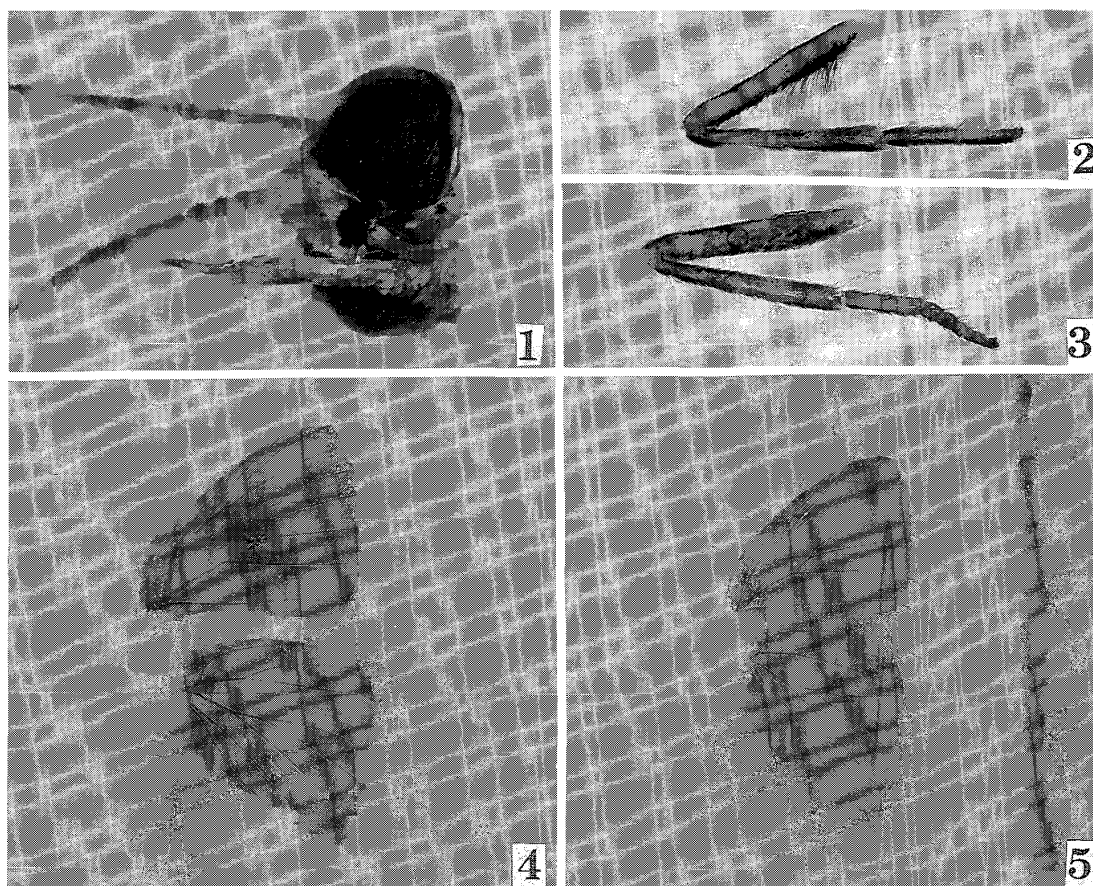
TM: The Toyosato Museum of Entomology, Tsukuba.

Tajuria discalis discalis Fruhstorfer, 1897 (Figs 1-11, 22)

Tajuria discalis Fruhstorfer, 1897: 49; Fruhstorfer, 1912: 213; Seitz, 1926: 975, pl. 156, row c, ♂.

Type. Holotype ♂, Indonesia: Lombok Island, Plateau von Sambalun auf 4000' April 1896. Other material. B. Pusuk, 1 ♂, viii. 1991; Lombok, 1 ♂, ix. 1991; 1 ♂, iv. 1992 (SM). Lombok, 1 ♀, vi. 1986 (SO); 1 ♀, v. 1992, 1 ♀, v. 1995 (SM).

Male. General characters (Figs 1-2, 4). Antenna: length about 0.45 (ratio to forewing length); 41 segments (only one specimen examined). Eye: not hairy. Femur: hairy.



Figs 1-5. *Tajuria discalis discalis*, Lombok. 1. Eye (♂). 2-3. Forelegs (2: ♂, 3: ♀). 4-5. Veins of both wings (4: ♂, 5: ♀).

Foretarsus: not segmented. Androconia: absent. Venation: 11-veined, vein 8 absent in forewing.

Wing markings (Figs 6-7). Upperside: Forewing shiny blue, with veins dusted with black but sometimes suffused with blue scales; costal to distal black border broad, more than 2/3 of vein 5; median black spot large, extending over dorsal portion of discal cell and basal portion of spaces 3-4 distinct; cilia black. Hindwing color as in forewing; costal border black, extending to space 6; cilia black from space 5 to tornus; anterior margin of space 2 projected distinctly along vein 3 and cilia white in this portion; tails black but white only at tip; submarginal black spots present in spaces 1b and 2 but obscure in space 1b; dorsum broadly black in spaces 1-1a, somewhat grayish basally, concaved remarkably in tornal area; less than 1/3 of cephalic portion of tornal lobe reddish orange whereas caudal portion is gray and caudal margin is whitish. Underside: Forewing ground color dark brown; discocellular bar absent; postdiscal fuscous band distinct from veins 1b-9; submarginal fuscous band slightly visible. Hindwing ground color brown; submarginal fuscous band traceable in spaces 4-6, marginal area rather blackish in these spaces; postdiscal fuscous band externally margined with white, nearly straight in spaces 4-7 but discontinuous and sinuate in spaces 1a-3; submarginal black spots in spaces 1a and 2 distinct; submarginal grayish area with outer white margin in spaces 1b-3; submarginal reddish orange area present in spaces 1a-3.

Genitalia (Fig. 22). Tegumen slightly swollen laterally, dorsally concaved at middle. Uncus absent. Brachium long and hooked. Juxta roundish, slightly swollen dorsolater-

ally in posterior view. Phallus short and stout, subzonal sheath about $2/3$ as long as entire length of phallus, suprazonal sheath isosceles triangular, weakly sclerotized laterally, swollen anteriorly, acutely narrowed posteriorly in lateral view. Valva triangular, slightly swollen and acutely tapering posteriorly, projected caudad in lateral view.

Female. General characters (Figs 3, 5). Femur: not hairy. Foretarsus: 5-segmented. Others as in male.

Wing markings (Figs 8-11). Upperside: Forewing shiny gray; costal to distal brown border broad, 0.4-0.6 of vein 2; cilia brown. Hindwing with shiny grayish scales basally, brown area remarkably broad from costa to tornus; cilia brown from space 5 to tornus; outer white margin conspicuous particularly in spaces 1a-2; submarginal black spot obscure, present in space 2; tornal spot dark orange, less than $1/3$ of the lobe; tails as in male. Underside: Forewing ground color ochereous brown; postdiscal fuscous band, externally margined with white, distinct from veins 1b-9, submarginal fuscous band slightly visible. Hindwing as in male but ground color ochereous brown, submarginal area orange in spaces 1a-3.

Genitalia (Fig. 22). Apophysis anterioris absent, apophysis posterioris nearly as long as 8th tergum or slightly longer. Lamella antevaginalis semicircular, developed laterally. Ostium bursae narrow and cylindrical caudad, well sclerotized ventrally. Signum absent.

Forewing length. Male: 17.0-17.9 mm ($n=3$, mean=17.5 mm), female: 17.0-19.0 mm ($n=3$, mean=17.9 mm).

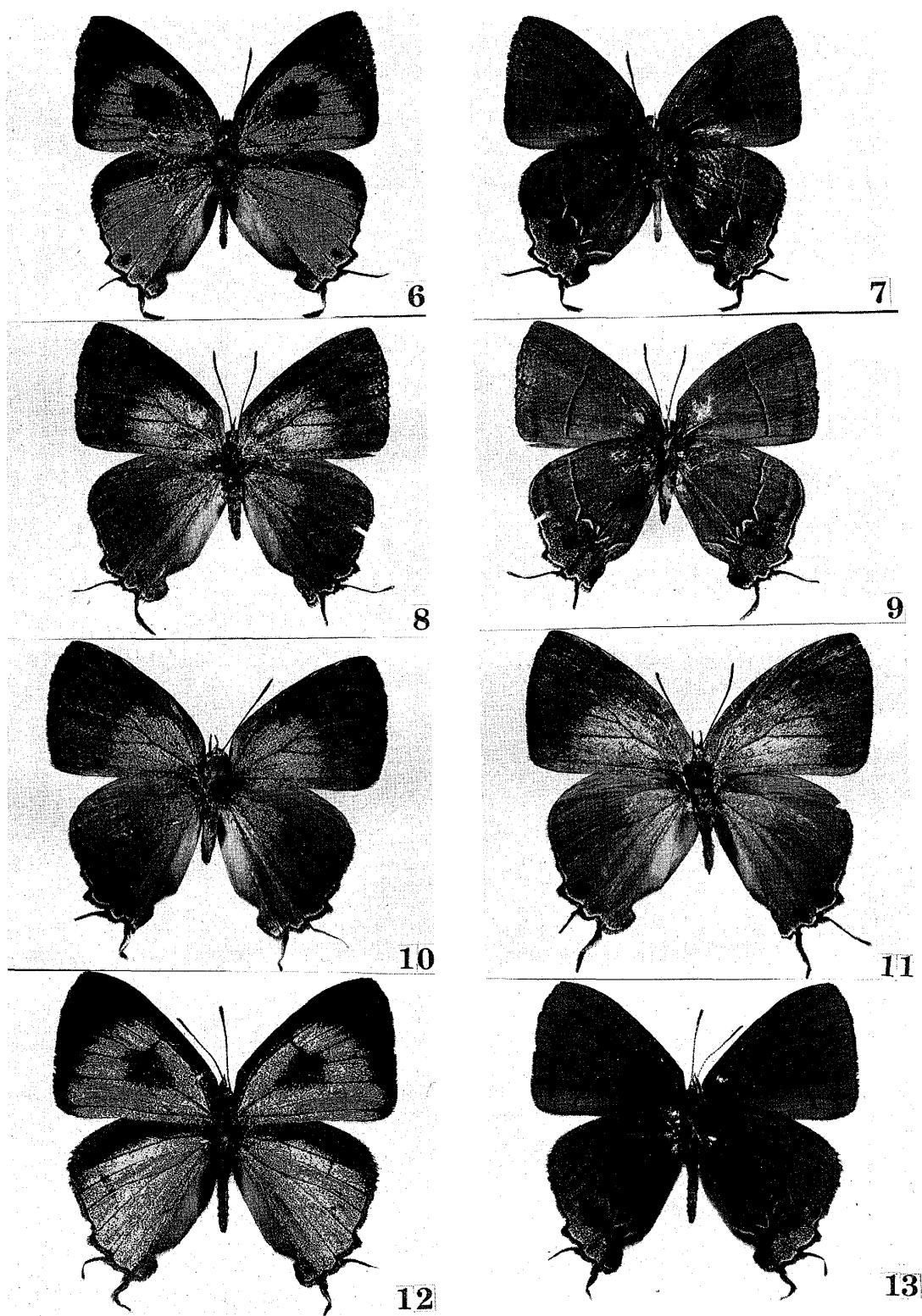
Distribution. Lombok. Type locality is Sembalun plateau in east Lombok, but recently obtained from west Lombok.

Tajuria discalis centralis ssp. nov. (Figs 12-17)

Types. Holotype: ♂, Lake Tamblingan (S. Morinaka leg.), central Bali, 28. iv. 1986 (SM). Paratypes: Bedugul, 1 ♂, 18. v. 1984; 1 ♂, 23. v. 1986; 1 ♂, 5. vi. 1987; Lake Tamblingan (S. Morinaka leg.), 1 ♂, 26. iv. 1987; 3 ♂, 1. v. 1993; 3 ♂, 28. viii. 1993 (KMNHIR 200,076, 1 ♂); central Bali, 1 ♂, iv. 1993; 2 ♂, v. 1995, 2 ♂, vii. 1995; Lake Buyan, 1 ♂, 24. iv. 1994; 1 ♂, iv. 1994; Munduk, 1 ♂, vi. 1995; 3 ♂, vii. 1995 (KMNH, MZB, OPU, SCSKU, SM). Lake Buyan, 1 ♀, 3. i. 1986 (K. Maruyama leg., SO); 1 ♀, Bali, 15. v. 1988 (SO); Lake Tamblingan, 1 ♀, 25. viii. 1993; 1 ♀, Munduk, vii. 1995 (SM). Other material. Lake Buyan (S. Morinaka leg.), 1 ♂, 28. iv. 1986; Bedugul, 1 ♂, 23. v. 1986; Lake Tamblingan (S. Morinaka leg.), 1 ♂, 26. iv. 1987; 1 ♂, 1. v. 1993; 1 ♂, 28. viii. 1993; 1 ♂, vii. 1995 (SM).

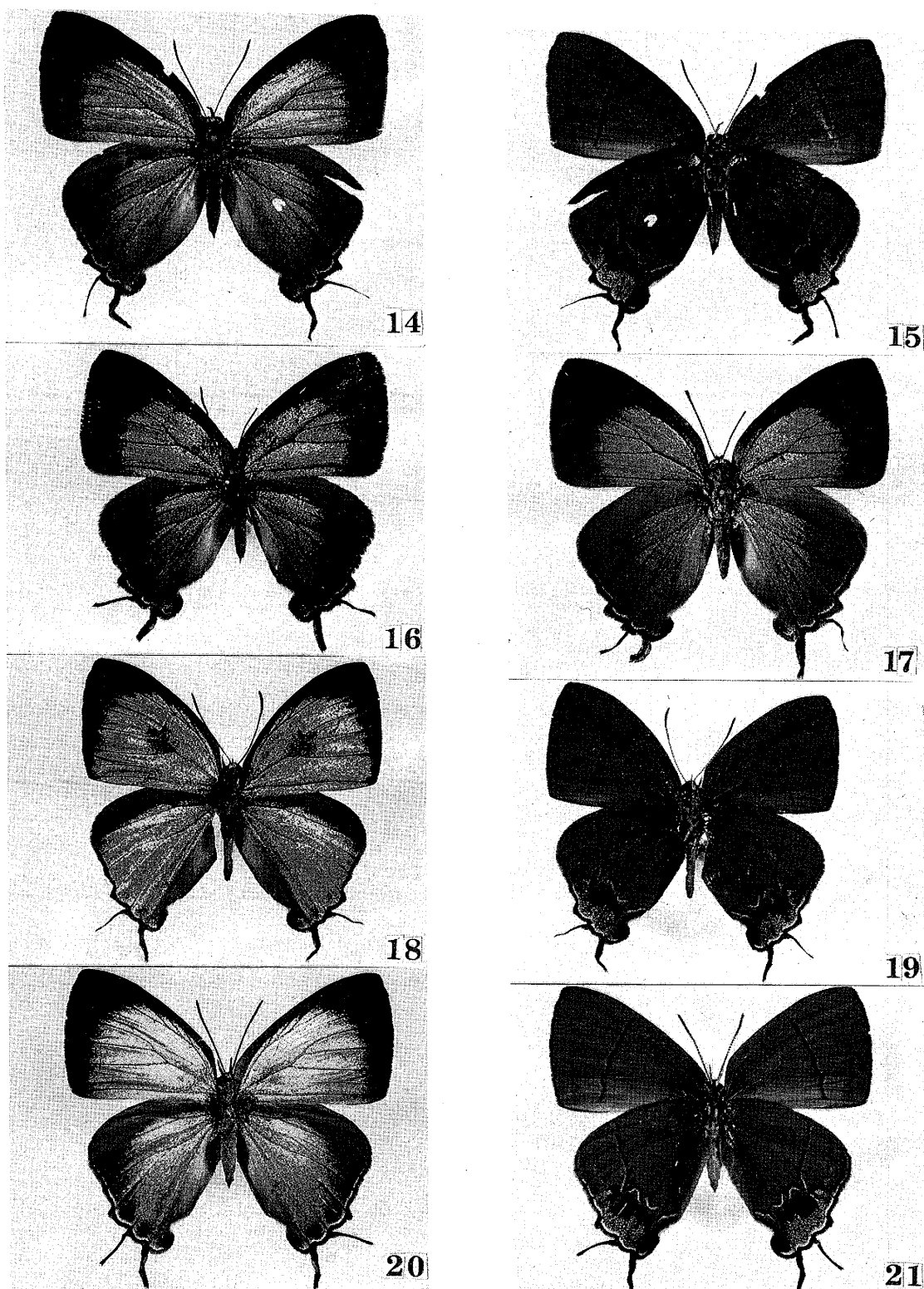
Male. Wing markings (Figs 12-13). Upperside: Forewing shiny blue, with veins dusted with black but sometimes suffused with blue scales; costal to distal black border broad, about $1/2$ of vein 5; median black spot relatively large, extending over dorsal portion of discal cell and cephalic portion of spaces 2-3; cilia black. Hindwing ground color as in forewing; costal border, cilia, and tails as in *T. discalis discalis*; submarginal black spots mostly absent in spaces 1b and 2; reddish orange spot less than $1/2$ of tornal lobe whereas caudal portion is gray. Underside: Forewing as in *T. discalis discalis* but discocellular bar sometimes obscurely present. Hindwing as in *T. discalis discalis*, external white margin of postdiscal band somewhat dull.

Female. Wing markings (Figs 14-17). Upperside: Forewings shiny light blue; costal to distal brown border relatively narrow, 0.3-0.4 of vein 2; cilia brown. Hindwing with



Figs 6-11. *Tajuria discalis discalis*, Lombok. 6. ♂, Forewing length (=F.L.) 17.5 mm. 7. *Ditto*, underside. 8. ♀, F.L. 17.8 mm. 9. *Ditto*, underside. 10. ♀, F.L. 17.0 mm. 11. ♀, F.L. 19.0 mm.

Figs 12-13. *T. discalis centralis* ssp. nov., central Bali. 12. Holotype, ♂, Lake Tamblingan, F.L. 18.6 mm. 13. *Ditto*, underside.



Figs 14-17. *T. discalis centralis* ssp. nov., central Bali. 14. ♀, Lake Tamblingan, F.L. 19.0 mm. 15. *Ditto*, underside. 16. ♀, Munduk, F.L. 17.1 mm. 17. ♀, Bali, F.L. 18.6 mm.

Figs 18-21. *T. discalis triangularis* ssp. nov., Mt Argopuro, east Jawa. 18. Holotype, ♂, F.L. 17.5 mm. 19. *Ditto*, underside. 20. ♀, F.L. 20.0 mm. 21. *Ditto*, underside.

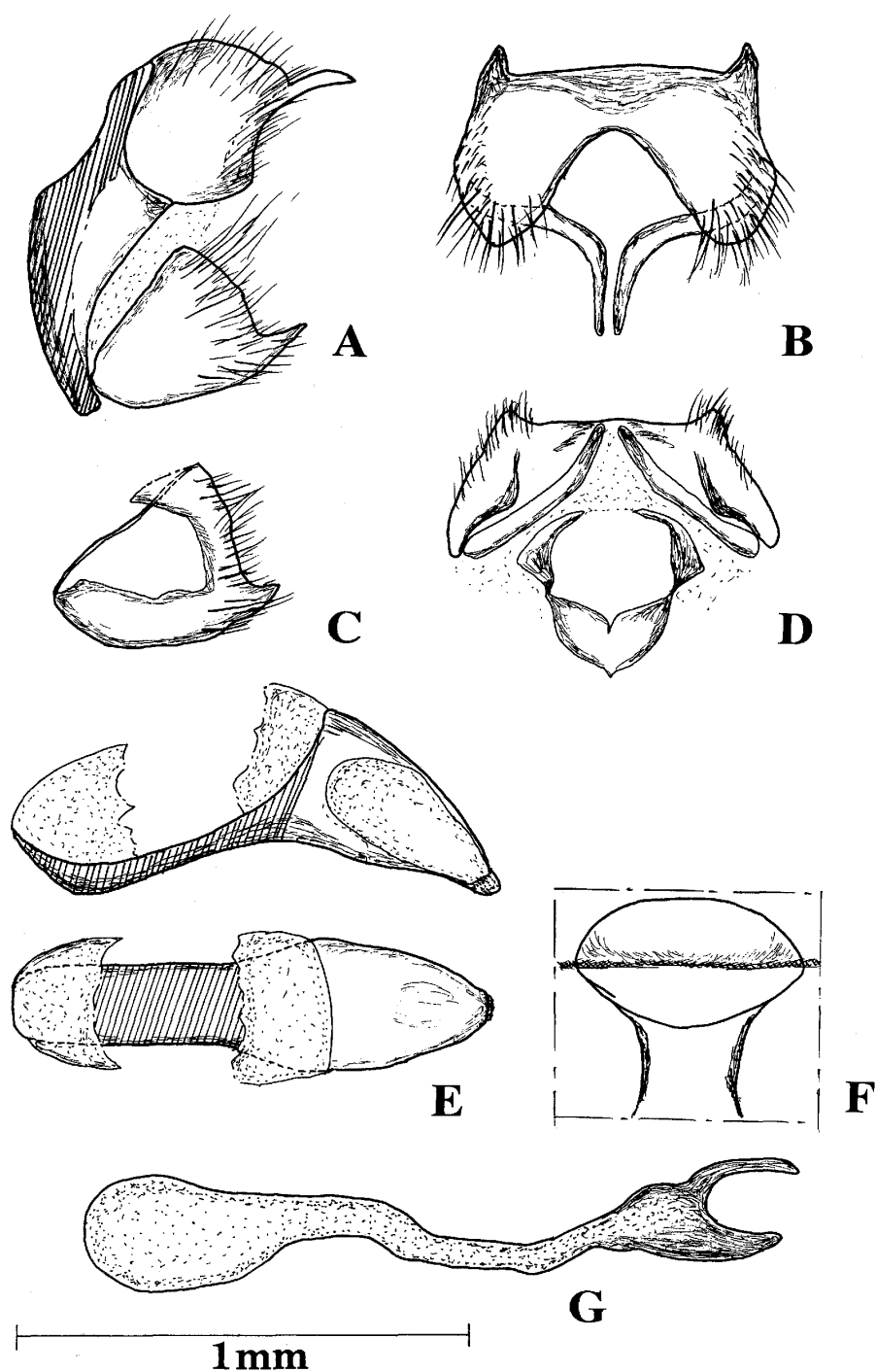


Fig. 22. Male (A-E) and Female (F-G) genitalia of *Tajuria discalis discalis* (A: ring and left valva (lateral view), B: dorsum (dorsal view), C: right valva (inner view), D: brachium and juxta (posterior view), E: phallus (upper: lateral view, lower: dorsal view), F: lamella antevaginalis and caudal portion of ostium bursae (ventral view), G: lamella antevaginalis, ostium, ductus and corpus bursae (lateral view)).

shiny light blue scales basally, brown area broad from costa to tornus; cilia brown from space 5 to tornus; outer margin white from spaces 1a-2; submarginal black spots sometimes obscurely present in space 2; tornal spot less than 1/2 of the lobe; tails as in male. Underside: Forewing as in *T. discalis discalis*, but somewhat darker in ground color. Hindwing as in *T. discalis discalis* but somewhat darker in ground color and external white margin of postdiscal fuscous band relatively obscure.

Remarks. This taxon is distinguishable from the nominotypical subspecies by the following wing markings. In male upperside of the forewing, costal to distal black border narrower, about 1/2 of vein 5, whereas 2/3 of that in the nominotypical subspecies. In female upperside of the forewing, ground color light blue while it is gray in the nominotypical subspecies. Costal to distal brown border narrower, 0.3-0.4 of vein 2, whereas 0.4-0.6 of that in the nominotypical subspecies. In female underside of both wings, ground color somewhat darker than that of the nominotypical subspecies.

Forewing length. Male: 15.5-19.2 mm (n=29, mean 18.2 mm), female: 17.1-19.0 mm (n=4, mean 18.1 mm).

Distribution. Central Bali.

Biology. Butterflies of this subspecies fly only in forests or forest edge of mountains at about 800 m or more in altitude. Usually they actively repeat flying and perching at leaves of canopy of broad leaf trees and males show territorial behavior during 10:00-14:00. But behaviors in the early morning and evening are not observed.

Etymology. The subspecific name, *centralis*, is derived from the type locality, central Bali.

***Tajuria discalis triangularis* ssp. nov.** (Figs 18-21)

Types. Holotype: ♂, Mt Argopuro, East Jawa, 10. v. 1993 (SM). Paratypes: Mt Argopuro, East Jawa, 1 ♂, 11. ix. 1989; 1 ♂, 19. ix. 1990; 1 ♂, 21. ix. 1991; 1 ♂, 10. x. 1991; 3 ♂, 11. x. 1991; 1 ♂, 12. x. 1991; 2 ♂, 23. i. 1992; 1 ♂, 25. i. 1992; 4 ♂, viii. 1992; 1 ♂, 12. ix. 1992; 1 ♂, 13. ix. 1992; 1 ♂, 14. ix. 1992; 1 ♂, 15. ix. 1992; 1 ♂, 16. ix. 1992; 1 ♂, 17. ix. 1992; 2 ♂, 19. ix. 1992; 1 ♂, 30. ix. 1992; 1 ♂, 6. x. 1992; 3 ♂, 10. x. 1992; 2 ♂, 14. x. 1992; 1 ♂, 15. x. 1992; 2 ♂, 18. x. 1992; 1 ♂, 21. x. 1992; 1 ♂, 28. x. 1992; 1 ♂, 1. xi. 1992; 1 ♂, 3. xi. 1992; 1 ♂, 7. xi. 1992; 1 ♂, 12. x. 1992; 7 ♂, 10. v. 1993; 5 ♂, 12. v. 1993; 3 ♂, 10. viii. 1993; 6 ♂, 11. viii. 1993; 1 ♂, 12. viii. 1993; 3 ♂, 13. viii. 1993; 5 ♂, 14. viii. 1993; 4 ♂, 25. x. 1993; 6 ♂, 26. x. 1993 (KMNHIR 200,077, 1 ♂); 2 ♂, iv. 1995; 19 ♂, vi. 1995. 1 ♀, 3. xi. 1989; 1 ♀, 9. v. 1990; 1 ♀, 21. x. 1990; 1 ♀, 7. ix. 1992; 1 ♀, 19. x. 1992; 1 ♀, 1. xi. 1992; 1 ♀, 2. xi. 1992; 1 ♀, 4. xi. 1992; 5 ♀, 10. v. 1993; 1 ♀, 11. viii. 1993; 2 ♀, 12. viii. 1993; 11 ♀, vi. 1995 (KMNHIR 200,078, 1 ♀) (KMNH, MZB, NSMT, OPU, SCSKU, SM, TM). Other material. 1 ♂, 9. xi. 1989; 1 ♂, 21. ix. 1990; 1 ♂, 12. x. 1991; 1 ♂, 8. ix. 1992; 1 ♂, 10. ix. 1992; 1 ♂, 17. ix. 1992; 1 ♂, 13. viii. 1993; 1 ♀, 9. xi. 1989; 1 ♀, 9. v. 1990; 1 ♀, 12. viii. 1993 (SM).

Male. Wing markings (Figs 18-19). Upperside: Forewing shiny blue; costal to distal black border narrow, about 1/3 of vein 5; median black spot small, reduced to ventro-distal corner of discal cell and basal portion of spaces 2-3, sometimes suffused with blue scales; cilia black. Hindwing ground color as in forewing; costal border, cilia, and tails as in *T. discalis discalis*; submarginal black spots present in spaces 1b and 2 but sometimes absent; reddish orange spot less than 1/2 of tornal lobe whereas caudal portion is gray. Underside: Forewing as in *T. discalis discalis* but discocellular bar sometimes traceable. Hindwing as in *T. discalis discalis*, submarginal fuscous band faded from spaces 4 to 6.

Female. Wing markings (Figs 20-21). Upperside: Forewing shiny light blue; costal to distal blackish brown border distinctly narrow, 0.2-0.3 of vein 2; cilia blackish brown. Hindwing ground color as in forewing, brown area relatively narrow; cilia brown from space 5 to tornus; tornal orange spot less than 1/2 of the lobe. Underside: Forewing as in *T. discalis discalis* but external white margin of postdiscal fuscous band somewhat dull. Hindwing as in *T. discalis discalis* but ground color somewhat darker and postdiscal fuscous band somewhat dull.

Remarks. This subspecies is distinguishable from the nominotypical subspecies and *centralis* ssp. nov. by the following wing markings. In male upperside of the forewing, costal to distal black border narrower, about 1/3 of vein 5 and median black spot much reduced. In female upperside of the forewing, ground color light blue and costal to distal brown border narrower, 0.2-0.3 of vein 2. In female underside of both wings, ground color somewhat darker than that of the nominotypical subspecies and a little paler than in *centralis* ssp. nov.

Forewing length. Male: 15.2-19.7 mm (n=108, mean 18.0 mm), female: 17.5-20.0 mm (n=34, mean 18.6 mm)

Distribution. Mt Argopuro, east Jawa.

Etymology. The subspecific name, *triangularis*, is derived from the characteristic shape of the suprazonal sheath of phallus and the valva of this species.

Discussion

Tajuria discalis is characteristic in having the stout phallus and the small triangular valva. As regards the structure of the genitalia, any significant differences were not found among *discalis* (s. str.), *centralis* and *triangularis*. Therefore the latter two are described as subspecies of *T. discalis*.

Murayama and Okamura (1973) described *Pratapa cleobis igolotiana* from the Philippines. Kawazoé (1973) transferred it into the genus *Tajuria* as a good species and Takanami (1989) pointed out the similarity between *T. discalis* and *T. igolotiana*. The authors examined various morphological characters of some *Tajuria* species and other lycaenid butterflies and the unique characters seen in the phallus and valva are found only in *T. discalis* and *T. igolotiana*. Therefore the characters are supposed as apomorphic, supporting the monophyly of these two species. *T. mantra* (C. and R. Felder, 1860) from Sulawesi which is similar to *T. discalis* in wing markings of female, is found not to have close relationship with *T. discalis*. The median black spot on the upperside of male forewing is not considered as apomorphy because it is also present in some other lycaenid species not having close kinship, e. g. *Tajuria dominus*, *Hypolycaena phorbas* and *Ancema ctesia*. If *T. discalis* and *T. igolotiana* are relics of the ice ages and their common ancestor migrated from the Sundaland, one or some taxa which have close kinship with these species may be found from mountainous area of the South-East Asia such as Borneo. Moreover in the Lepidoptera, even restricted to butterflies, strong biogeographical relationship of Sulawesi and Mindanao (Philippines) are stressed by many authors (de Jong, 1983, 1990; Chiba, 1988, 1989; Vane-Wright, 1991; Hirowatari, 1993). Presence of *igolotiana* in the Philippines and *discalis* in the Lesser Sunda Islands may suggest a discovery of either of them or any unknown taxa having the synapomorphies with them from Sulawesi.

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摘 要

ディスカリスタカネフタオシジミ (インドネシア) の研究 (1) (森中定治・新川 勉)

Tajuria discalis (ディスカリスタカネフタオシジミ, タカネフタオシジミ属, シジミチョウ科) の原名亜種の再記載と中央バリ, 東ジャワに生息する個体群をそれぞれ, 新亜種 *T. d. centralis*, *T. d. triangularis* として記載し, 生態的知見の報告, ならびに系統関係の推定に関する若干の議論を行った.

T. d. centralis は, 雄は前翅表面の外縁黒帯が細く (第5脈の 1/2 程度), 一方原名亜種は幅広いこと (第5脈の 2/3 程度), 雌は両翅表面基部の淡青色が原名亜種では灰色であること, 後翅表面の外縁黒帯が細く (第2脈の 0.3-0.4 程度), 一方原名亜種は幅広いこと (第2脈の 0.4-0.6 程度) などから識別できる. *T. d. triangularis* は, 雄は前翅表面中央部の黒班が小さくなること, 同外縁黒帯がさらに細く (第5脈の 1/3 程度) なること, 雌は両翅表面基部の淡青色が原名亜種では灰色であること, 後翅表面の外縁黒帯がさらに細く (第2脈の 0.2-0.3 程度) などから識別できる. また, *T. d. centralis* は, 800 m 以上の山地の林内および林縁で観察された. 10:00-14:00 に, 広葉樹の周辺で飛翔と葉上での静止を繰り返すテリトリー行動が観察された.

T. discalis と *T. igolotiana* の類似性については最初, 高波 (1983) が指摘した. 筆者等は, 交尾器を含む形質状態を, 他の *Tajuria* 属を含む種々のシジミチョウと比較検討した結果, *T. igolotiana* が *T. discalis* と単系統群を構成する最も近縁な種であることを見出した.

これらの種が, スンダランドから移動してきた氷河期の遺存種であるなら, その近縁種がボルネオなどの山岳地帯に生息する可能性が考えられる. さらに鱗翅目, 特にチョウに限っていても, 多くの研究者がスラウェシとミンダナオの生物地理学的な関連性を指摘している. *T. discalis* がジャワ-小スンダ列島に, その近縁種 *igolotiana* がフィリピンに生息することから, 分布の空白地帯であるスラウェシにこれらと単系統群を構成する未知種, あるいはこれらの種のいずれかが発見されることも予測される.

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